93D CONGRESS } HOUSE OF REPRESENTATIVES { REPORT
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SOLAR HEATING AND COOLING DEMONSTRATION ACT OF 1973

JANUARY 28, 1974.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. TEAGUE, from the Committee on Science and Astronautics, submitted the following

REPORT

[To accompany H.R. 11864]

The Committee on Science and Astronautics, to whom was referred the bill (H.R. 11864) to provide for the early commercial demonstration of the technology of solar heating by the National Aeronautics and Space Administration and the Department of Housing and Urban Development, in cooperation with the National Bureau of Standards, the National Science Foundation, the General Services Administration, and other Federal agencies, and for the early development and commercial demonstration of technology for combined solar heating and cooling, having considered the same, report favorably thereon without amendment and recommends that the bill do pass.

PURPOSE OF THE BILL

The purpose of the bill is to demonstrate within three years, using current technology, the practical use on a large scale of solar heating technology; and to develop and demonstrate on a large scale within five years the practical application of combined solar heating and cooling technology.

EXPLANATION OF THE BILL

This bill provides $50 million over a five-year period for the commercial demonstration of solar energy for heating and cooling residential and commercial buildings. It should be emphasized that H.R. 11864 does not set forth a comprehensive national solar energy R. & D. program. Rather, it accomplishes the very important and timely "next step" required to implement the large-scale, practical use of solar energy in the immediate future.

Solar energy has received greatly increased attention from Congress, the scientific community, and the public, a fact well documented by the Committee. Proposals were presented to the Committee for utilizing solar energy to heat and cool buildings, as well as for large scale terrestrial solar energy conversion and huge satellite electric power stations in space. Other proposals included bioconversion, wind conversion and ocean thermal gradient utilization.

Testimony before the Committee indicates that only the area of solar energy heating and cooling of buildings is now ready for commercial exploitation on a large scale. However, only about 30 solar heated buildings have been constructed in the entire world, and the operating experience necessary for large scale commercial implementation of this technology does not exist. A commercial demonstration of the economic viability of solar heating and cooling is a necessary step in attaining the goal of widespread commercial production and marketing of solar heating and cooling systems for millions of American homes.

H.R. 11864 provides a two-stage demonstration program. The National Aeronautics and Space Administration (NASA) will be in charge of the initial phase which will consist of contracting for the research, development and manufacture of solar heating and combined solar heating and cooling equipment.

The second phase, including responsibility for installation of the equipment, monitoring and dissemination of information will be managed by the Department of Housing and Urban Development.

The residential solar heating program is programmed for three years; the residential combined heating and cooling program for five years; and the heating and cooling program for commercial buildings for five years.

Statement of Policy

The bill declares that it shall be the policy of the United States to accomplish the demonstration of the practical use of solar heating technology within three years (using current technology for this purpose), and to accomplish the research, development, and demonstration of the practical use of combined solar heating and cooling technology within a five-year period.

Amendment of the NASA Act

The bill amends Section 203 of the National Aeronautics and Space Act of 1958 to make explicit NASA's authority to carry out activities prescribed by H.R. 11864.

Development of Residential Solar Heating Systems

The development of solar heating systems for residential dwellings shall be carried out by NASA. This includes the responsibility for contracting for the development, prototypes (if needed), and manufacturing of the systems in substantial numbers. "Substantial numbers" will be administratively defined, but in any case 1,000 units is deemed to meet the requirement for each category of the demonstration program, a total of 4,000 units under all sections of the bill.

The solar heating systems developed and contracted for by NASA must meet performance criteria prescribed by the National Bureau of Standards (NBS). These performance criteria are to be published 120 days after enactment of the bill. NBS will also prescribe performance criteria for the residential dwellings in which the equipment is to be installed, in order to assure satisfactory performance of the solar heating systems under varied climatic conditions. A design competition for homes meeting these performance criteria will be conducted by NBS so that an adequate number of "off the shelf" designs will be available to individuals and small builders to install solar heating systems.

The solar heating systems manufactured under contract to NASA are to be installed, half in Federal and half in private residential dwellings. Installation in Federal dwellings shall be carried out under arrangements made by the Secretary of Defense. The Secretary of Housing and Urban Development shall arrange for installation in privately owned and occupied residences.

Ownership of the heating systems shall remain with the United States Government for five years after installation. During this period, HUD utilizing NBS, will monitor and evaluate the performance and operation of the systems. At the end of this five-year period, in ex-

change for cooperation in the monitoring and evaluation program, title shall be transferred at no charge to the owner of the residences in which the equipment is installed. During the period of Government ownership, the expense of maintenance and repair of the heating system shall be borne by the Government.

Since HUD has general responsibility for administering this demonstration program after the heating systems have been manufactured, it also has responsibility for the monitoring and evaluation functions. It is expected that NBS will be delegated as much responsibility as possible in this regard. HUD must also report on the progress of the demonstration, and maintain a continuing liaison with the building industry and related industries during and after the demonstration program. The liaison will be directed toward assuring that the benefits of this demonstration program will be realized by the Nation on a continuing basis.

Development of Residential Combined Solar Heating and Cooling Systems

The assignment of administrative responsibilities for the combined heating and cooling demonstration program for residential dwellings is similar to that for the heating program. The major exception is that NASA is authorized to undertake a research and development program for combined solar heating and cooling systems that would meet the performance criteria. It is anticipated that this research and development phase will require about two years, hence the total time planned for the combined heating and cooling program is five years.

Commercial Buildings

NASA and HUD, in a phased program similar to that for residential buildings, are directed to concurrently carry out solar heating and cooling demonstration projects with respect to a wide range of commercial buildings, such as school, industrial, office, agricultural, and apartment structures.

NBS is to participate in the commercial demonstration in ways similar to its participation in the residential dwelling program. Because of its unique responsibility for public buildings, the General Services Administration is expected to play an important role in this aspect of the overall program.

Amendment of NSF Act

The NSF Act of 1950 is amended to require the Foundation to initiate and support basic and applied research in solar heating and cooling in support of H.R. 11864. NSF is authorized to use funds appropriated directly to the Foundation or transferred to it from NASA or other agencies.

Dissemination of Information—Information Data Bank

As part of its responsibilities to assure continuing public benefit from this program, HUD is required to undertake comprehensive programs that would assure dissemination of all relevant information produced under this demonstration program. In addition to coverage in the annual reports of the various agencies participating in this demonstration program, HUD shall submit to the President and Congress a summary annual report detailing all activities relating to programs under this bill.

HUD is also charged with establishing and operating a Solar Heating and Cooling Information Bank. This bank shall collect, review, process and disseminate information on solar heating and cooling in order to support the objectives of the bill, and encourage the widespread utilization of information related to solar heating and cooling of buildings and water.

Studies and Investigation

HUD is charged with studying, investigating and reporting on ways that building codes, zoning ordinances, and other laws and practices can be modified in order to facilitate widespread use of solar energy for heating and cooling buildings.

Increased Ceilings on Federally Assisted Mortgages or Federally Constructed Housing

The bill provides for an increase in the ceilings on federally assisted mortgage loans, to the extent of the increased cost resulting from installation of solar heating and/or cooling systems. Unit cost ceilings of federally constructed housing are also increased to this extent.

The increases apply only to buildings specifically incorporated into this demonstration program. The amount of the increases may include but are not limited to the solar heating and/or cooling equipment, and special construction materials.

Small Business

All Federal agencies participating in this demonstration program are charged with taking steps to assure adequate participation by small business firms.

Transfer of Functions

Research and development functions vested in NASA and NSF by this bill would be transferred to any new permanent organization having jurisdiction over energy R. & D., such as the proposed Energy Research and Development Administration, should such an agency be established by law.

Authorization of Appropriations

$50 million is authorized to be appropriated to NASA to carry out the demonstration bill for the five fiscal years beginning after the enactment of the bill.

BACKGROUND

For some decades, private inventors and other interested individuals have taken the lead in developing the technology for heating and cooling buildings with solar energy. Various government agencies have supported small solar R. & D. programs, but only in this decade has government support exceeded one million dollars annually. In a real sense these pioneering private and agency activities have been responsible for developing the technological base needed for a demonstration program such as that provided under this bill.

Legislative interest in solar energy has recently become widespread. Numerous bills related to solar research, development and demonstration programs have been introduced, and have received careful attention from this Committee. These earlier bills, including legislation introduced in both the present and the previous Congresses, provided much information and many valuable ideas that were incorporated in this bill as reported by the Committee. These previously-introduced bills also demonstrated the widespread congressional support for solar energy, and encouraged the Committee to take the initiative in reporting out this landmark legislation.

Funding History for Solar Energy R. & D.

Prior to the fiscal year 1971 Federal budget, obligations for solar energy R. & D. were not well documented and amounted to at most a few hundred thousand dollars annually for all forms of solar energy conversion. In fiscal year 1971, the NSF budget included $1.2 million for all forms of solar research, with $540,000 devoted specifically to research on heating and cooling of buildings.

Table 1 shows how NSF funding for solar energy R. & D. has varied over the last several years. The recent emphasis on solar energy for heating and cooling of buildings is indicative of a realization of the near-term importance of this application, with obligations for the current fiscal year of $5.6 million, out of a total solar research budget of $13.2 million. This support is expected to rise a great deal more over the next several years.

Other agencies have also been involved in solar R. & D. over the last several years, but at much more modest levels than NSF. For fiscal 1974, budgets for all forms of solar energy conversion (not just heating and cooling) are: NASA ($900,000), AEC ($600,000), and DOD ($200,000).

TABLE 1.—NSF SOLAR ENERGY R. & D.

[In millions of dollars]

	Fiscal year—			
	1971 (actual)	1972 (actual)	1973 (actual)	1974 (estimate)
Solar energy for buildings	0.54	0.19	0.50	5.9
Solar thermal conversion	.06	.55	1.43	2.2
Photovoltaic conversion		.43	.89	2.4
Bioconversion for fuels	.60	.35	.65	1.0
Wind conversion			.26	1.0
Ocean thermal difference conversion		.14	.23	.7
Total	1.20	1.66	3.96	13.2

Energy Task Force Report

The legislative beginnings of H.R. 11864 are contained in the report of the Task Force on Energy of the Committee on Science and Astronautics. This Task Force was constituted specifically for reviewing energy matters during the 92nd Congress. At the conclusion of the 92nd Congress, following thorough investigation and study during 1971 and 1972, the Task Force submitted its final report. A major conclusion of that report was that, because of the continuous and virtually inexhaustible nature of solar energy, solar energy R. & D. should receive increased emphasis and funding.

The Task Force report noted that the fossil fuels upon which we depend today were formed by solar energy in the past. Food, wind, wood, and hydropower are all derived from solar energy. Solar energy is available everywhere and is almost limitless. If man can learn to develop solar power economically, it is a nearly ideal source of energy.

The body of the Task Force report emphasized three distinct uses of solar energy, each with its own problems and time scale, as being worthy of increased attention: dispersed, small-scale use for heating and cooling buildings and water; large-scale terrestrial solar energy collection and conversion into electricity; and large-scale satellite electric power plants.

Based upon briefings from experts and its own study, the Task Force concluded that with minor engineering development and relatively simple architectural modifications, solar energy could now be used for space heating of residential and industrial buildings, and the heating of water. The report also noted that in a few years solar energy might be practical for cooling as well.

Committee Staff Report—December, 1972

The conclusions of the Energy Task Force were further supported by a Committee Staff Report "Solar Energy Research" dated December, 1972. This report presented views of the National Aeronautics and Space Administration, the National Science Foundation, the National Bureau of Standards, and the Congressional Research Service of the Library of Congress on how to better assure utilization of solar energy, and supported the need for increased funding. It endorsed the conclusion that solar heating and cooling is practical using current technology.

NSF–NASA Solar Energy Panel Report—December, 1972

About the same time as the Committee Staff Report described above, a report was published by the Solar Energy Panel led by the National Science Foundation and the National Aeronautics and Space Administration. This panel was one of several technical panels commissioned by the now defunct Office of Science and Technology to review all energy technologies. Many of the facts contained in this study are also contained in the previously described Committee Staff Study, but the Panel report is much more detailed.

The portion of the report devoted to solar heating and cooling of buildings noted the present state of near readiness for commercial exploitation. It proposed a staged program for Federal R. & D., and called for a demonstration phase similar to that authorized by this bill. Several of the principal authors of this section of the Panel report were witnesses in the November hearings described below, including Mr. Richard Schoen, of UCLA (also speaking for the Space-Conditioning Panel Chairman, Dr. Jerry Weingart, from the California Institute of Technology) and Mr. Richard Rittleman, an architect with Burt, Hill and Associates of Butler, Pennsylvania.

Solar Energy Field Trips—1973

The Committee's Subcommittee on Energy in 1973 made three field trips to evaluate solar heating and cooling technology. The Subcommittee visited the solar heated home of Mr. Harry Thomason in the Washington, D.C. area; the solar heated and wind powered home and laboratories of Mr. Robert Reines near Albuquerque, New Mexico; and the Los Alamos Scientific Laboratory, Los Alamos, New Mexico, which is building a solar heated library building.

Solar Energy Legislation in the 93rd and Earlier Congresses

Legislation in the 93rd Congress.—By the close of the 1st session of the 93rd Congress, 11 different solar energy bills had been introduced in the House and Senate. Some of these were broad in scope, covering the research and development of all aspects of solar technology. Most, however, are aimed at just the development of solar heating and cooling technology for buildings—the solar application reputed to be closest to commercial use. In addition to the 11 bills dealing specifically with solar energy, several general energy bills have been introduced, such as S. 70, H.R. 9090, S. 2135, and others, which include provisions for the development of the unconventional or little-used energy sources such as solar. The following is a brief summary of the 11 specific solar energy bills introduced in the 1st session of the 93rd Congress:

H.R. 9696 (Mr. Runnels). Introduced July 30, 1973 to establish an Office of Solar Energy Research in the Department of the Interior with authority to coordinate, conduct, encourage, and promote, by means of research grants and contracts, basic research to develop economical processes for using solar energy. The bill authorizes the development of solar conversion technologies to the point where they can be demonstrated, certified, produced, and operated in a practical manner. Funding not to exceed $125 million is authorized to carry out the provisions of the Act during the fiscal years 1974 to 1978, inclusive. (Referred to the Committee on Science and Astronautics.)

H.R. 10479 (Mr. Vanik). Introduced September 24, 1973 to promote the development of solar technology by authorizing the Secretary of Commerce (1) to establish a system of grants for solar energy research and (2) to establish a Solar Energy Data Bank. The Data Bank would serve as a technical and scientific library and evaluation center with respect to the development and use of solar energy. Grants authorized by the bill are to be made for research leading to the design, manufacture, and marketing of solar energy heating and cooling equipment for homes and office buildings. NBS is directed to establish testing procedures and performance standards for such equipment, as well as to perform cost analyses and collect weather data. Funding as might be needed for research grants is authorized for fiscal years 1975 through 1984, inclusive. (Referred to the Committee on Science and Astronautics.)

H.R. 10952 (Mr. McCormack). Introduced October 16, 1973 to provide for the early commercial demonstration of the technology of solar heating and cooling by the National Aeronautics and Space Administration, the National Bureau of Standards, the National Science Foundation, the Department of Housing and Urban Development, the Department of Defense, and other agencies. It provides for the demonstration of solar heating technology on a large scale in three years, and the demonstration of the technology for combined solar heating and cooling of buildings in five years. It further provides for a five-year demonstration program of solar heating and cooling of commercial buildings, factories, and industrial buildings. The total cost of these programs over the five year period, including installation of approximately 2,000 mass produced solar heating units and 2,000 mass produced solar heating and cooling units in residential dwellings will be $50 million.

The bill was referred to the Committee on Science and Astronautics, and, after detailed study and hearings in November, was ordered reported out of committee favorably on December 20, 1973. The clean bill, H.R. 11864, has a provision for a Solar Heating and Cooling Information Data Bank to be established within HUD, and a provision which will allow the functions contained in the bill to be transferred to the Energy Research and Development Administration or any other permanent Federal organization that is created having jurisdiction over the energy research and development functions of the United States.

H.R. 11542 (Mr. Vanik). Introduced November 15, 1973 to amend the Public Buildings Act of 1959 so as to encourage the use of solar energy in the heating and cooling systems of public buildings. The bill specifies that no appropriation shall be made to construct or acquire any building to be used as a public building and no appropriation shall be made to alter any public building involving an expenditure in excess of $10,000 unless the Administrator of G.S.A. transmits to the Congress an energy use statement with respect to any such proposed construction, acquisition, or alteration. It also provides that the Committee on Public Works of the Senate and House shall not approve any project for construction of any public building under subsection (a) unless such project provides for the use of solar energy to meet the heating and cooling requirements of such building, to any

extent to which the use of solar energy is economical and efficient. (Referred to the Committee on Public Works.)

H.R. 11566 (Mr. Lehman). Introduced November 26, 1973 to (1) direct the Secretary of Commerce to research and develop new building designs and construction methods which utilize solar energy and (2) authorize the Secretary of Housing and Urban Development to increase the maximum amount of mortgages insured under title II of the National Housing Act for certain facilities utilizing solar energy. The Secretary of Commerce is further authorized to prescribe standards and specifications for solar buildings within one year after enactment of the bill and specify the climatic regions of the United States where the use of solar buildings is practicable. The Secretary of HUD may increase the maximum amount of a mortgage insured under the National Housing Act by the amount by which the cost of using solar systems exceeds the cost of using conventional building systems. (Referred to the Committee on Banking and Currency.)

H.R. 11933 (Mr. Vanik). Introduced December 12, 1973 to amend the Internal Revenue Code of 1954 to provide for the amortization of facilities used for the manufacture of solar heating and cooling equipment. The five-year amortization period provided for by the bill is in lieu of the depreciation deduction with respect to such facilities. The taxpayer may elect to take the amortization deduction beginning either with the month following the month in which the certified solar heating and cooling equipment manufacturing facility is completed, or with the taxable year succeeding the taxable year in which the facility is completed. (Referred to the Committee on Ways and Means.)

Amendment No. 624 (Mr. Cranston). Introduced October 10, 1973 to amend the Housing Act of 1973 (S. 2182) to provide for the establishment of major demonstration projects to test the economic and technical feasibility of solar energy as an energy source for the heating and cooling of both single family and multi-family housing. The Secretary of Housing and Urban Development in collaboration with the National Science Foundation is authorized to undertake demonstration projects throughout the country. The Secretary is authorized to enter into contracts with individuals and entities with special competence and knowledge to contribute to the planning, design, development, and operation of such housing. Finally, the Secretary is directed to report to the Congress annually on his effort. Funds, not to exceed $5 million which shall remain available until expended are authorized to be appropriated for demonstrations. (S. 2182 is being considered by the Banking, Housing and Urban Affairs Committee.)

S. 2636 (Mr. McGovern). Introduced October 30, 1973 to authorize supplemental appropriations for the National Science Foundation's solar, hydrogen, and geothermal research and development programs. Specifically, the bill authorizes an additional $80 million for NSF's RANN solar energy program for FY 1974 and $400 million for the program for each of the four fiscal years beginning July 1, 1974. In addition, the bill authorizes $50,000 for a feasibility study regarding the establishment of a National Data Bank for Solar, Hy-

drogen, and Geothermal Energy for FY 1974. (Referred to the Committee on Interior and Insular Affairs.)

S. 2650 (Mr. Cranston). Introduced November 2, 1973 to direct the Secretary of Housing and Urban Development to undertake a major demonstration program to determine the practical feasibility of solar heating and cooling in residential and commercial buildings. This would involve the development of appropriate standards and building codes, the awarding of an adequate number of designs to test existing technology and innovations, and the actual construction of solar-powered buildings. The Secretary of HUD will have overall responsibility for this program, for implementing, monitoring, and evaluating it, after he has consulted with the National Solar Energy Coordinating Council. This Council will be composed of the following, or their designees: The Administrator of NASA, the Director of NSF, the Administrator of General Services, the Director of NBS, the Administrator of EPA, the President of NAS, three members representing the public, and any additional Federal department or agency heads whom the President may name. The bill provides for an immediate three-year demonstration program for solar heating, and a five-year development and demonstration program for combined solar heating and cooling systems. A maximum of $50 million is authorized to carry out the purposes of the act. (Read twice and, by unanimous consent, referred to the Committees on Banking, Housing and Urban Affairs and Commerce jointly, and if and when one of the above reports, then to the Committee on Labor and Public Welfare.)

S. 2658 (Mr. Moss). Introduced November 5, 1973 as a companion bill to H.R. 10952. (Read twice and referred to the Committee on Aeronautical and Space Sciences.)

S. 2819 (Mr. Humphrey). Introduced December 17, 1973 to establish an Office of Solar Energy Research within the Atomic Energy Commission to carry on a vigorous program of research and development of all solar energy applications. The Chairman of AEC, acting through the Office of Solar Energy Research and in conjunction with NSF and NASA would (1) conduct by means of grants and contracts basic research to develop economical processes for using solar energy; (2) conduct appropriate research and technical development work (a) to determine the usable results of the basic research and all existing research and (b) to develop and fabricate solar energy transformation processes and equipment to the point where they can be commercialized; (3) recommend to the Congress authorizations for the construction and operation of solar energy conversion facilities; and (4) undertake, through research grants and contracts, studies of possible environmental effects which will result from the use of solar energy. The bill also establishes a Solar Energy Research Council to be headed by the Chairman of the AEC to coordinate policy and programs in solar energy research. There are authorized to be appropriated $56 million for FY 1975, $94 million for FY 1976, and $150 million for each of the succeeding three fiscal years. (Read twice and referred to the Committee on Atomic Energy.)

Legislation in Earlier Congresses.—A small number of bills dealing specifically with the development of solar technology were introduced in earlier Congresses. None of them passed. One, S. 2318, was a basic

research and development bill first introduced by Mr. Bible in 1959 and later in 1961 by Mr. Hosmer. It authorized the Secretary of the Interior to make grants to private institutions and to use the facilities of existing Federal scientific laboratories to conduct research and technical development of techniques for the practical utilization of solar energy. The bill authorized $10 million to be spent over a ten-year period. A similar bill was introduced jointly by Mr. Humphrey in the Senate and Mr. Anfuso in the House in 1962. This bill differed from Mr. Bible's bill in that it provided for the establishment of a Solar Energy Advisory Board, composed of five scientists, to work with the Secretary of the Interior on a consulting basis. The bill was reintroduced in 1964 by Mr. Humphrey and again in 1965 by Mr. Schmidhauser. A new bill, H.R. 12438, was introduced in 1967 by Mr. Miller, to authorize the Secretary of the Interior to grant contracts to public or private institutions for the research and development of techniques for the practical utilization of solar energy. Other bills which would have accelerated the development of solar technology had they passed were S. 2510, introduced in 1971 by Mr. Moss, and an amendment to S. 3103 (the AEC authorization bill), introduced in 1972 by Mr. Gravel. Mr. Moss's bill would have established a corporation for the development of new energy sources, including solar, and Mr. Gravel's amendment would have provided $15 million for solar research and development. There follows a summary of these and other solar energy bills introduced in earlier Congresses.

H.R. 4286 (Mr. Murdock). Introduced May 28, 1951 to authorize the Secretary of the Interior to perform the necessary research and development to construct and operate a demonstration windpower plant. The plant is to demonstrate the economic and commercial feasibility of producing electric power and energy by means of a wind-driven generator operated in conjunction with an electric power system. During the demonstration period, generated power shall be delivered into the power system of the Federal project with which the demonstration plant is integrated. At such time as the Secretary determines that the feasibility of the plant has been established, the experimental period shall end and the demonstration plant shall be transferred to the power system of the Federal project with which it is then integrated. Congress will from time to time appropriate the funds deemed necessary to carry out the provisions of the act. Bill did not pass.

S. 2318 (Mr. Bible). Introduced July 1, 1959 to authorize the Secretary of the Interior to make grants to private and educational institutions and to use the facilities of existing Federal scientific laboratories to conduct research and technical development of techniques for the practical utilization of solar energy. Research undertaken by the Secretary of the Interior shall be coordinated or conducted jointly with the Department of Defense. Sums not to exceed $10 million are appropriated to carry out the provisions of the Act during the fiscal years 1959 to 1968, inclusive. Bill did not pass.

H.R. 6558 (Mr. Hosmer). Senator Bible's bill (S. 2318) reintroduced April 20, 1961 with the authorization period changed to the fiscal years 1961 to 1968, inclusive. Bill did not pass.

S. 2849 (Mr. Humphrey). Introduced February 15, 1962, S. 2849 is similar to S. 2318 and H.R. 6558 except that it also provides for the establishment of a Solar Energy Advisory Board, composed of five scientists, to work with the Secretary of the Interior on a consulting basis. Sums not to exceed $10 million are authorized to carry out the provisions of the Act during the fiscal years 1962 to 1968, inclusive. Bill did not pass.

H.R. 10203 (Mr. Anfuso). Companion bill introduced on the same day in the House. Bill did not pass.

S. 2853 (Mr. Humphrey). Introduced May 18, 1964. Identical to S. 2849. Bill did not pass.

H.R. 3434 (Mr. Schmidhauser). Introduced January 25, 1965. Identical to S. 2849. Bill did not pass.

H.R. 12438 (Mr. Miller). A short bill introduced August 17, 1967 to authorize the Secretary of the Interior, in consultation with other interested agencies, to engage by contract or otherwise, public or private institutions in a program of research and development in techniques for the practical utilization of solar energy. The Secretary is also authorized to encourage activities outside the Federal Government which will contribute to such a program. There are authorized to be appropriated such sums as may be required to carry out the purposes of this Act. Bill did not pass.

S.J. Res. 184 (Mr. Tower). Introduced March 24, 1970 to authorize the Secretary of the Interior to conduct a study of the solar rays with a view to determining the potential of such rays as an alternative source of electrical energy. A sum not to exceed $500,000 is authorized for a two year period following the date of approval of the resolution. Bill did not pass.

S. 2510 (Mr. Moss). Introduced September 14, 1971 to establish a corporation for the development of new energy sources. The Corporation (New Energy Sources Corporation) is authorized to enter into contracts or other arrangements with public or private institutions to conduct research and development related to its mission. The bill authorizes $5 million for the fiscal year beginning July 1, 1972 to permit the initial organization of the Corporation, and for each of the next five succeeding fiscal years, such sums as may be necessary. Section 3 (c) deals with solar energy and directs the Corporation to select among the most feasible methods for the utilization of solar energy when such processes have reached the stage of development that they are ready to be demonstrated. The Corporation is then authorized to design, construct, operate, and maintain demonstration facilities that are required to prove the technical and economic feasibility of the processes selected. If, on the basis of the demonstration, the Corporation determines that methods so demonstrated are technically and economically feasible for producing energy on a commercial scale, the Corporation is authorized to produce energy by such method. Bill did not pass.

Amendment to S. 3103, the AEC authorization bill for fiscal 1973 (Mr. Gravel). Introduced February 14, 1972 to provide $15 million for solar energy research and development. The amendment authorizes the Commission to conduct solar energy research and development in

order to accelerate the demonstration of large-scale solar power systems. Of the $15 million authorized to be appropriated for the fiscal year ending June 30, 1973, $150,000 shall be expended to fund adversary experts to independently investigate and publicly reveal alleged hazards and adverse ecological and economic implications of solar power projects under development. Mr. Gravel introduced a similar amendment in July 1971 to authorize the AEC to spend $3 million on solar research. Amendments did not pass.

June 1973 Investigative Hearings

Witnesses provided expert advice during hearings on June 7 and 12, 1973 on the current state of the art for solar space conditioning systems, and defined as carefully as possible the economics of such systems in terms of today's market. Testimony and Member questions focused on the economic, technological, and institutional obstacles to widespread commercial utilization of solar heating and cooling technology and on the steps that should be taken to accelerate the commercialization of solar heating and cooling for homes and commercial buildings. The witnesses who advised the subcommittee were, in the order of their appearance:

1. Professor George Löf of Colorado State University.
2. Dr. James Comly, Manager, Thermal Branch, Corporate Research and Development, General Electric Company.
3. Walter A. Meisen, Assistant Commissioner for Construction Management, Public Building Service, GSA.
4. Fred S. Dubin, P.E. of Dubin-Mindell-Bloom Associates.
5. Ralph J. Johnson, Staff Vice President, National Association of Home Builders Research Foundation.

In addition to the oral testimony received, written statements were received from the following:

1. Dr. James C. Fletcher, Administrator, National Aeronautics and Space Administration.
2. John K. Tabor, Acting Secretary of Commerce, Department of Commerce.
3. Arthur I. Mendolia, Assistant Secretary of Defense (Installations and Logistics), Department of Defense.
4. Karl W. Böer, director, Institute of Energy Conversion, University of Delaware.
5. J. A. Duffie, director, Solar Energy Laboratory, Engineering Experiment Station, College of Engineering, the University of Wisconsin.
6. Sheffield Nelson, president, Arkansas Louisiana Gas Co.
7. William J. Bailey, president, Carrier Corp.
8. William C. Dackis, vice president and assistant to the president, Crane Co.
9. Herman Barkmann, P. E., president, Sun Mountain Design, Ltd.
10. D. C. Burnham, chairman, Westinghouse Electric Corp.
11. J. W. Kennedy, president, York Division, Borg-Warner Corp.
12. Harold R. Hay, member, board of directors, the International Solar Energy Society, Sky Therm Processes and Engineering.

13. Robert G. Reines, director, ILS Laboratory, Integrated Life-Support Systems Laboratories for Spaceship Earth.

14. P. Richard Rittleman, Burt, Hill & Associates, architects.

15. L. N. Hunter, managing director, Air-Conditioning and Refrigeration Institute.

16. H. E. Thomason, J. D., president, Thomason Solar Homes, Inc.

The witnesses agreed that the use of solar energy for space heating, air conditioning, and water heating in buildings is the most promising near-term application of solar energy. Professor Löf saw the application as being technically feasible and closely approaching economic viability. He advised that with a vigorous program of research and development it would be possible to have commercial solar heating and cooling equipment within three to five years that would compete in cost with conventional systems. Dr. Comly had no doubt that "it will be technically feasible to heat water and to heat and cool interior building space using the sun as the major energy source." Mr. Meisen was equally optimistic about the potential of this application. He stated, "We, in the General Services Administration, believe the time is ripe for a major expansion in the use of solar energy in this country to heat and cool buildings. We believe the technology and hardware is available to begin making large solar energy installations."

Witnesses identified three classes of obstacles to the commercial use of solar hardware—economic, technological, and institutional. It is clear that the three classes are not strictly separable, for example, very strong relationships exist between the technological effort to manufacture solar equipment at low cost and the resolution of the economic barrier of high initial cost.

The substantially higher first cost of solar heating and cooling systems compared to conventional systems was generally considered the greatest single barrier to the widespread commercial use of solar hardware. The substantial increase in initial cost of a building, represented by solar hardware, is unacceptable to most building purchasers even though the economic justification of the additional first cost can be demonstrated when the savings in the cost of fuel over the lifetime of the building are considered. Professor Löf stated that a "solar heating system for an average house is going to add perhaps $2,000 to the price of that house, and I'm told by people who know the building industry pretty well that this is a horrible thought to the usual builder-developer."

Mr. Dubin, whose firm is working with GSA in the design of two solar-conditioned Federal office buildings, stated that solar energy "is economically competitive with electric resistance heating and cooling now. It will be economically competitive with conventional oil or gas-fired systems in the very near future anywhere in the country." He substantiated his economic assessment of solar energy with the results of a cost analysis performed on GSA's Manchester, New Hampshire solar building: "Without a very sophisticated collector, and without thorough integration of the system, the solar heating and cooling system would operate on a life cycle cost basis about 25 percent less than straight electric resistance heating at today's cost and would cost about 20 to 25 percent more than gas or oil at today's cost." Mr. Dubin and other witnesses anticipated that the cost ad-

vantage now enjoyed by conventional heating and cooling systems would soon be offset by rising costs for gas and oil, and that rise has, of course, recently occurred. Dr. Löf predicted (in June) that if solar collectors, the most expensive component in a solar space conditioning system, can be mass manufactured at a cost of $2 to $4 per square foot, then "solar heat can be supplied to buildings for space heating, water heating, and cooling at costs seldom more than double current oil and gas costs; in some localities solar energy is fully competitive, and in virtually all situations solar costs are substantially below those associated with electric heating."

The availability of lower cost solar hardware through mass manufacture would certainly enhance the economic position of solar heating and cooling systems. But until life cycle or total lifetime costs are considered in cost estimating, the initial capital investment required for solar space conditioning will continue to be a serious marketing problem. Mr. Johnson urged "special information programs for mortgage bankers, appraisers and government personnel concerned with mortgage loan insuring and guaranteeing programs to assure full credit for reduced heating and cooling operating costs when using solar energy. This is needed to offset the increased mortgage payments due to higher first costs of solar equipment, if we are to prevent the disqualification of a large number of potential buyers because of the higher first cost of the solar energy installations."

The principal technological obstacle to the application of solar energy for building services is the fact that no solar-equipment industry exists today. Dr. Comly knew of no major manufacturer of appliances or of heating and cooling equipment which includes solar-fired equipment in its product line. To be useful in providing the energy requirements for buildings services, solar hardware will probably have to be introduced into the market in a manner similar to the way furnaces, air conditioners, major appliances, and other durable consumer goods are introduced. The technological requirement for success in this market includes the existence of an industry which pursued the design of devices for low cost mass manufacture, for durability, and for reliable performance with simple maintenance procedures.

Dr. Comly defined the requirements for a commercial system in very precise terms: Once an optimum design is selected, "a detailed design of the products must be made using experience, intuition, and innovation to minimize first cost, the critical problem for solar energy today, while maintaining reliability, automatic operation, ease of installation, serviceability, and environmental compatibility." Until solar devices can be produced in such a way as to meet these requirements, there will probably be no wide-spread application. Even though solar heating systems have been demonstrated in numerous experimental homes, the systems that have been tested lack the design sophistication and economic position to be competitive with the well established conventional heating and cooling systems. As Dr. Löf stated, "we are not quite at the point in the development of solar energy, or solar heating and cooling, and in the price of fuels to provide a high assurance to an industrial firm that if they were to commit heavy investment to tooling up for manufacture that they would have a substantial market."

The principal institutional barrier to successful use of solar energy in buildings is the present lack of a coordinated effort among the diverse institutions which interact to affect construction. In order for solar devices to be introduced into wide-spread application in buildings, designers, builders, codes and standards agencies, financial institutions, and equipment suppliers must cooperate. Mr. Johnson provided good insight into the attitude of the home building industry which, if solar space conditioning is to become a reality, is the industry that will be first involved. He pointed out trends in current construction, such as emphasis upon townhouses and apartments, that may discourage the use of solar hardware. He also noted that the mere demonstration of solar space conditioning will not be enough to bring it into the housing market. A major change in outlook will be required of home buyers, home builders, and financiers.

On the whole, the collective advice of the witnesses indicated that solar space conditioning and water heating is at the stage where research and development needs to be supplemented by demonstration projects and incentives to cause home builders and buyers to start to use this technology. From the standpoint of public policy, the question developed was whether to rely upon present funding of solar energy research and evolving economic forces to bring solar space conditioning to the commercial market, or whether to expedite its earlier application through expanded federally supported programs. The latter choice was that of the Committee, based on the testimony and the urgency of the energy problem.

Introduction of H.R. 10952

Following the June hearings described above, committee staff with the assistance of the Congressional Research Service of the Library of Congress, the House Legislative Counsel's Office, and outside experts in the solar energy field, prepared a bill to provide for demonstration of solar heating and cooling in accordance with the testimony received, and the wishes of the Committee. The purpose of the bill has already been described—to provide for an effective demonstration of solar heating and cooling technology. The intent was two-fold: to help generate a new industry, and to help generate a new market.

The first bill, H.R. 10952, was cosponsored by the Chairmen and ranking minority members of the Subcommittee and Committee. It was introduced on October 16, 1973, and an introductory statement by Subcommittee Chairman Mike McCormack appeared in the Congressional Record of October 30, 1973.

Legislation Identical to H.R. 10952

The widespread support in Congress for accomplishing the goals of this legislation was demonstrated by 185 Members sponsoring legislation identical to H.R. 10952. A list of these Members and the bills which each introduced is given below. Mr. Flowers and Mr. Benitez, although not sponsors of bills identical to H.R. 10952, are cosponsors of H.R. 12079 and H.R. 12248 identical to the clean bill, H.R. 11864.

Alexander	H.R. 11430	Badillo	H.R. 11058
Anderson of Ill	H.R. 11180	Bafalis	H.R. 11431
Annunzio	H.R. 11058	Baker	H.R. 11057
Archer	H.R. 11056	Bell	H.R. 11028
Aspin	H.R. 11057	Bergland	H.R. 11027

Bevill ---------- H.R. 11179
Biester ---------- H.R. 11795
Bingham ---------- H.R. 11058
Blatnik ---------- H.R. 11056
Boggs ---------- H.R. 11432
Boland ---------- H.R. 11431
Breaux ---------- H.R. 11058
Brotzman ---------- H.R. 11077
Brown of Calif ---------- H.R. 11027
Broyhill of N.C ---------- H.R. 11179
Burgener ---------- H.R. 11056
Burke of Calif ---------- H.R. 11432
Byron ---------- H.R. 11431

Camp ---------- H.R. 11027
Carney ---------- H.R. 11056
Casey ---------- H.R. 11432
Chappell ---------- H.R. 11839
Clausen ---------- H.R. 11554
Cleveland ---------- H.R. 11058
Cohen ---------- H.R. 11430
Collier ---------- H.R. 11179
Collins of Ill ---------- H.R. 11430
Collins of Tex ---------- H.R. 11179
Conlan ---------- H.R. 11027
Conte ---------- H.R. 11179
Corman ---------- H.R. 11056
Cotter ---------- H.R. 11027
Coughlin ---------- H.R. 11180
Cronin ---------- H.R. 11027
Culver ---------- H.R. 11430

Danielson ---------- H.R. 11056
Davis of Georgia ---------- H.R. 11028
Dellums ---------- H.R. 11058
Downing ---------- H.R. 11028
Drinan ---------- H.R. 11179
du Pont ---------- H.R. 11432

Edwards of Ala ---------- H.R. 11056
Edwards of Calif ---------- H.R. 11179
Esch ---------- H.R. 11028
Eshleman ---------- H.R. 11058

Fish ---------- H.R. 11056
Foley ---------- H.R. 11430
Forsythe ---------- H.R. 11430
Fraser ---------- H.R. 11056
Frenzel ---------- H.R. 11180
Frey ---------- H.R. 11028
Froehlich ---------- H.R. 11057
Fulton ---------- H.R. 11431
Fuqua ---------- H.R. 11028

Gilman ---------- H.R. 11180
Ginn ---------- H.R. 11795
Goldwater ---------- H.R. 10952
Grasso ---------- H.R. 11432
Green of Oregon ---------- H.R. 11430
Gunter ---------- H.R. 11027

Hamilton ---------- H.R. 11431
Hanna ---------- H.R. 11028
Harrington ---------- H.R. 11179
Harvey ---------- H.R. 11058
Hastings ---------- H.R. 11058
Hechler of W. Va ---------- H.R. 11028
Helstoski ---------- H.R. 11058
Hicks ---------- H.R. 11058
Hinshaw ---------- H.R. 11431
Hogan ---------- H.R. 11179
Holt ---------- H.R. 11431
Horton ---------- H.R. 11795
Huber ---------- H.R. 11432
Hunt ---------- H.R. 11821

Johnson of Calif ---------- H.R. 11431
Johnson of Colo ---------- H.R. 11056
Johnson of Penna ---------- H.R. 11821
Jones of Okla ---------- H.R. 11431
Jordan ---------- H.R. 11179

Keating ---------- H.R. 11057
Kemp ---------- H.R. 11056
Ketchum ---------- H.R. 11180

Lehman ---------- H.R. 11430
Lent ---------- H.R. 11057
Long of Md ---------- H.R. 11057
Lujan ---------- H.R. 11430

McClory ---------- H.R. 11431
McCloskey ---------- H.R. 11430
McCormack ---------- H.R. 10952
McDade ---------- H.R. 11058
McEwen ---------- H.R. 11431
McKay ---------- H.R. 11431
McKinney ---------- H.R. 11058

Maraziti ---------- H.R. 11181
Martin of N.C ---------- H.R. 11027
Mayne ---------- H.R. 11056
Mazzoli ---------- H.R. 11430
Meeds ---------- H.R. 11056
Melcher ---------- H.R. 11179
Metcalfe ---------- H.R. 11058
Michel ---------- H.R. 11431
Milford ---------- H.R. 11027
Mitchell of N.Y ---------- H.R. 11058
Moorhead of Calif ---------- H.R. 11058
Mosher ---------- H.R. 10952

Nedzi ---------- H.R. 11431

Obey ---------- H.R. 11430
Owens ---------- H.R. 11430

Parris ---------- H.R. 11027
Patten ---------- H.R. 11431
Pepper ---------- H.R. 11056
Pettis ---------- H.R. 11821
Pickle ---------- H.R. 11027
Poage ---------- H.R. 11179
Podell ---------- H.R. 11179
Pritchard ---------- H.R. 11057

Quie ---------- H.R. 11056

Rarick ---------- H.R. 11431

Rees	H.R. 11180
Reuss	H.R. 11058
Rhodes	H.R. 11432
Rinaldo	H.R. 11432
Robinson of Va	H.R. 11056
Robison	H.R. 11179
Rodino	H.R. 11431
Roe	H.R. 11028
Roncalio	H.R. 11057
Roncallo	H.R. 11057
Rosenthal	H.R. 11057
Roush	H.R. 11057
Rousselot	H.R. 11821
Roy	H.R. 11057
Runnels	H.R. 11432
Ryan of Calif	H.R. 11432
St Germain	H.R. 11721
Sarasin	H.R. 11431
Sarbanes	H.R. 11430
Scherle	H.R. 11057
Schroeder	H.R. 11179
Seiberling	H.R. 11432
Shoup	H.R. 11430
Shriver	H.R. 11056
Sisk	H.R. 11056
Skubitz	H.R. 11432
Snyder	H.R. 11430
Stanton of Ohio (J. William)	H.R. 11056
Stark	H.R. 11430
Steiger of Ariz	H.R. 11179
Studds	H.R. 11058
Sullivan	H.R. 11057
Symington	H.R. 11028
Taylor of Missouri	H.R. 11821
Teague	H.R. 10925
Thomson	H.R. 11057
Thone	H.R. 11430
Thornton	H.R. 11027
Tiernan	H.R. 11795
Treen	H.R. 11430
Udall	H.R. 11057
Ullman	H.R. 11430
Vander Jagt	H.R. 11839
Vanik	H.R. 11056
Walsh	H.R. 11057
Ware	H.R. 11179
White	H.R. 11057
Wilson of Calif	H.R. 11179
Wilson of Texas	H.R. 11057
Winn	H.R. 11028
Won Pat	H.R. 11430
Wright	H.R. 11057
Wyatt	H.R. 11058
Wydler	H.R. 11028
Wylie	H.R. 11821
Wyman	H.R. 11431
Yatron	H.R. 11431
Young of Ga	H.R. 11056
Young of S.C	H.R. 11058
Young of Ill	H.R. 11057
Young of Fla	H.R. 11431
Zwach	H.R. 11179

November 1973 Hearings on H.R. 10952

Following the introduction of H.R. 10952 and identical bills, hearings were promptly scheduled. These took place on November 13, 14, and 15, 1973, with both morning and afternoon sessions on the latter two days. The 23 witnesses, representing Federal agencies, industry, university research organizations, and environmental groups generally endorsed the concept of the demonstration project, its timeliness, and general administrative features.

The witnesses and the emphases of their testimony, in the order of their appearance before the Subcommittee were:

1. Dr. James C. Fletcher, Administrator, National Aeronautics and Space Administration. He supported the bill, and also called for creation of the Energy Research and Development Administration (ERDA).

2. Dr. H. Guyford Stever, Director, National Science Foundation. He supported the demonstration concept, but felt ERDA management was important and the large scale demonstration called for in H.R. 10952 was premature.

3. Dr. Betsy Ancker-Johnson, Assistant Secretary for Science and Technology, Department of Commerce. She supported the demonstration concept with ERDA management. She also advocated a strong role for the National Bureau of Standards.

4. Mr. Peter Michel, Acting Deputy Assistant Secretary for Policy Development and Research, Department of Housing and Urban Development. His statement was little more than a strong plea for the creation of ERDA. In response to committee questions he indicated his general support of the demonstration concept, with strong participation by HUD in all phases.

5. Dr. Peter Glaser, Vice President for A. D. Little Co. He felt the bill was too timid, and did not go far or fast enough. He heads an industrial solar study, and felt industry is now ready to produce on a large scale solar heating and cooling equipment, but needs government incentives.

6. Mr. P. Richard Rittleman, Burt, Hill and Associates, Butler, Pennsylvania. A leading solar-oriented Architect and Mechanical Engineer, he called for more emphasis on the commercial building portion of the demonstration program.

7. Dr. Erich Farber, Solar Energy Laboratory, University of Florida. He indicated that solar technology is ready for such a large-scale demonstration, but urged even greater speed than envisioned in the bill.

8. Prof. Raymond Reed, Dean, College of Architecture and Environmental Design, Texas A & M University. He provided strong support and advocated expanded national coverage and greater participation by architectural schools and students.

9. Mr. William Rush, Manager, Systems Applications Research, Institute of Gas Technology. His testimony showed near solar readiness of their new heat exchanger. His answers to Committee questions showed his support of the bill.

10. Mr. Sheldon Kinsel, Conservation Liaison, National Wildlife Federation. He gave enthusiastic support and wanted to expand bill to other energy conservation areas.

11. Mr. Wilson Clark, Energy Consultant, Environmental Policy Center. He supported the concept of the bill enthusiastically, while urging a number of extensions into other energy-related areas.

12. Mr. Warren Christian, President, Solec Company. He gave testimony on solar heating products produced by his company. His answers to Committee questions indicated support for the bill.

13. Rear Admiral Nathan Sonenshein, Defense Energy Task Group. He supported the bill without mentioning ERDA. He gave an understanding of how DOD would participate, citing specific financial and legislative needs.

14. Mr. Walter Meisen, Assistant Commissioner for Construction Management, Public Buildings Service, General Services Administration. He supported the bill and called for creation of ERDA. He demonstrated GSA interest and competence, and expressed interest in having GSA included in the bill.

15. Mr. Ralph Johnson, Staff Vice President, National Association of Home Builders Research Foundation, Inc. His strong support for the bill was qualified by a call for time and funding increases.

16. Mr. Frederick D. Hunt, Jr., Director of Program Development, Mobile Home Manufacturers Association. He generally supported the bill and pointed out special needs of mobile home manufacturers and owners in utilizing solar energy.

17. The Hon. Charles Vanik, Member of Congress from Ohio. Mr. Vanik offered numerous amendments, some following from legislation he had introduced independently. He was generally enthusiastic about the bill.

18. Prof. Richard Schoen, School of Architecture/Urban Planning, UCLA. He concentrated on institutional barriers to the introduction of solar heating and cooling, and offered numerous modifications. He generally supported the bill.

19. Mr. J. Frederick Weinhold, Senior Engineer, Energy Policy Project. He concentrated on the future role of solar energy and identified some of the hurdles to be overcome. He generally supported the legislation.

20. Mr. Jack Bologna, Director, New Products Development, PPG, Inc. He concentrated on the virtues of proper glass selection for solar collectors, and the need for Federal financial support of industrial supplies for a new solar industry. He supported the bill in response to Committee questions.

21. Dr. Ian R. Jones, Manager, Thermal Energy Systems Department, TRW Systems. He described TRW work on a current $550,000 NSF grant, and earlier work on HUD Project Breakthrough. He supported the intent of the bill, but pointed out that work is under way on major problem areas identified by the bill.

22. Dr. Jesse C. Denton, Director, National Center for Energy Management and Power, University of Pennsylvania. He supported the concept of the bill with a delay in the cooling portion, increased funds, and possible joint office management.

23. Mr. Donald A. Urquhart, Manager of Special Projects, Lighting Products Division, Corning Glass Works. He described his company's efforts in developing concentric cylindrical tubular solar collectors. He urged increased speed and funding.

The oral testimony was supplemented by written statements from:

1. Hon. J. J. (Jake) Pickle of Texas.
2. Hon. Goodloe E. Byron of Maryland.
3. Mr. William Bailey, president, Carrier Corp.
4. Mr. D. C. Burnham, Chairman, Westinghouse Corp.
5. Consulting Engineers Council of the United States.
6. Dr. James Comly, manager, Thermal Branch, General Electric Corporate Research and Development.
7. Mr. William C. Dackis, vice-president and assistant to the president, Crane Co.
8. Mr. Fred Dubin, P.E., Dubin-Mindell-Bloome Associates.
9. Mr. J. W. Kennedy, president, York Division, Borg-Warner Corp.
10. Mr. L. T. Papay, director, Research and Development, Southern California Edison Co.
11. Mr. Jerry Plunkett, president, Materials Consultants, Inc.
12. Hon. Dixy Lee Ray, Chairman, Atomic Energy Commission.

13. Mr. William A. Shurcliff, senior research associate, Harvard University.

14. Mr. Edson W. Spencer, executive vice president, Honeywell.

15. Ms. Rosalyn L. Switzen, National Education Ombudswoman.

16. Mr. H. E. Thomason, J.D., president, Thomason Solar Homes, Inc.

A primary concern of the Committee was whether the bill provided adequate time for the successful demonstration of heating and cooling technology. Five witnesses felt that three years were about right for the heating demonstration, five felt it too short, and three felt it too long. For the combined heating and cooling demonstration, two witnesses expressed concern that it was too short and one specifically stated that it was adequate. Generally the Committee felt that the expert testimony found the three and five year goals to be reasonable ones.

A second major concern of the Committee concerned the adequacy of the $50 million authorization. Although eight of the witnesses felt the amount was too little, four witnesses specifically stated that the amount was sufficient and the others made no specific comment. Closely related to the dollar limitation question is that of the number of units. Very few of the witnesses specifically commented on this question, but three felt the number was too high, while two specifically stated it was too low.

A third concern of the Committee was the adequacy of the proposed administrative structure. Witnesses representing executive agencies called for using the proposed Energy Research and Development Agency (ERDA) as the administrative agency. Two other witnesses suggested further strengthening the role of the Department of Housing and Urban Development, and several other witnesses urged that the areas of responsibility be more carefully delineated. None of the witnesses specifically argued against utilizing NASA for contracting for the solar equipment or HUD for installing and monitoring the heating and/or cooling systems.

A fourth major concern of the Committee was whether or not solar technology had evolved to the point that it is now reasonable to begin a demonstration program. Ten witnesses specifically indicated their agreement with the view that now is the time to begin such a demonstration. Only Dr. Stever voiced concern that the undertaking was premature. Several witnesses indicated that the bill, rather than being premature, moved too slowly.

A wide range of possible amendments were proposed by witnesses. Among those adopted by the Committee and described in a later section were suggestions for a solar data bank; removal of Federal mortgage and construction ceilings for housing involved in the demonstration projects; modifications in the design competition; emphasis on a need for increasing the number of regions and the number of manufacturers involved; a greater emphasis on commercial buildings; inclusion of GSA among the participating agencies; inclusion of solar hot water demonstrations if desirable; and providing more time to NBS for the preparation of equipment and building performance criteria.

There were many other valuable suggestions which were not included as amendments to the bill itself. Some were already permitted but not required by the language of the bill; others were really administrative in nature, involving decisions that should be made by the administrators after the program has been initiated. Further discussion of some of these will be found under "Committee Views."

Several witnesses were concerned that the demonstration units be insured under existing HUD insurance programs for experimental projects.

Questions were raised about patent policy, with emphasis on the need to encourage manufacturers to enter this demonstration project.

A number of witnesses discussed the need for legislation concerning sun rights or three dimensional zoning. Others addressed building codes, labor jurisdictional questions, needs of industrial suppliers for solar equipment manufacturers, and any other impediments to builder and consumer acceptance.

There were requests by three witnesses to expand the scope of the bill to declare a Federal long-range commitment to support solar heating and cooling, perhaps going so far as to mandate solar heating for all Federal buildings. Witnesses Glaser, Kinsel, Johnson, and Weinhold called for allowing greater flexibility for the administrator, including the possibilities for subsidies and authority for ad-hoc negotiations. Witnesses Reed and Rittleman called for the mandating of metric units in the bill; Mr. Rittleman also noted the need for subsystem compatibility.

Witnesses who were architects as well as representatives of the building industry made suggestions concerning the design competition called for in the bill. They emphasized its importance and urged the inclusion of all qualified participants, including manufacturers, builders, and students.

Witnesses Ancker-Johnson, Sonenshein, Schoen, and Weinhold urged the use of control houses, and careful test procedures. Other witnesses urged careful consideration of the siting of the houses. Witness Schoen went further and urged the taking of a complete history on the project, stating that this would be a unique and valuable contribution to allow improvements in future demonstration projects.

Witnesses Vanik and Hunt urged that community units be allowed. Witnesses argued on both sides of the question as to whether retrofitting units on existing structures should be stressed. Witnesses Vanik, Reed, and Denton urged the widest possible geographical spread of the solar units.

Several witnesses called for the inclusion of the public and various interest groups in the administration of this demonstration project.

Mention was made of the Experimental Research and Development Program (ERDIP) at NSF and the Experimental Technology incentives Program (ETIP) at NBS, and their potential relationships to the demonstration program.

Mr. Schoen urged a complete Technology Assessment of the solar heating and cooling area. Mr. Rittleman noted that previous technological innovations have followed a "Filter down" process, beginning with the commercial market and expensive, architect-designed residential units.

In summary, the hearings were a most valuable source of excellent ideas, many of which appeared in the final version of the bill, H.R. 11864. The witnesses almost without exception supported increased Federal funding to encourage rapid initiation of this new form of space conditioning. They broadly endorsed the time scale, funding level, and administrative mechanisms proposed by the legislation.

COMMITTEE ACTIONS

Markup in Subcommittee of H.R. 10952

On December 11, 1973, a quorum being present, the Subcommittee on Energy marked up the original bill (H.R. 10952 and identical measures), approving a number of amendments. Suggestions for many of these amendments arose in the course of the November hearings described above. Some of the amendments were substantive, others were minor, technical, and conforming changes. All such amendments were incorporated into a clean bill (H.R. 11864).

Throughout the bill, changes in language were made to show more explicitly the delineation of agency responsibilities, and to more clearly define the two distinct phases of the demonstration program and the associated management functions. In addition, language changes were made to clarify responsibilities of the agencies to consult with each other as appropriate during the demonstration. In the first phase, NASA would have major responsibility for developing the solar heating and cooling equipment; in the second phase HUD would have major responsibility for installation, testing, and evaluation of the equipment and housing, as well as the dissemination of information and data. Major functional duties were not reassigned, but a clearer delineation of agency responsibility was set forth.

Two new findings were added (Section 2) which point up the beneficial effect of solar energy heating and cooling upon the environment and the assistance it can render toward the elimination of U.S. dependence upon foreign energy imports.

The General Services Administration was specifically written into the bill in Section 7 in recognition of the lead role that it can play in promoting the objectives of this program's commercial building program. Acknowledgement of this major role is also seen in the inclusion of GSA in the Act at several places.

A major amendment was adopted as Section 9(c) that would require the Secretary of Housing and Urban Development to establish and operate a Solar Heating and Cooling Information Data Bank. This data bank is described in the Explanation and Sectional Analysis Sections.

A new section was added (becoming Section 10) that raised the maximum dollar amounts for federally-assisted mortgage loans and maximum allowable unit costs of federally-constructed housing involved in this demonstration. Generally, this provision authorizes existing statutory and/or regulatory maxima on loans and unit costs to be increased in the amount by which the cost of providing solar heating and/or cooling exceeds the cost of providing conventional heating and/or cooling systems.

Many witnesses called the attention of the Subcommittee to the fact that many bills before the Congress would establish a single depart-

ment or agency within the Executive Branch to centralize direction and control over energy research and development. One such bill to create an Energy Research and Development Administration has been passed by the House. To avoid any conflict with such organizational changes, the Subcommittee approved an amendment (becoming Section 13) to provide that within sixty days after enactment of any law creating an Energy Research and Development Administration or other permanent Federal organization responsible for energy research and development functions, responsibilities assigned to NASA and NSF under the provisions of this bill will be transferred to and vested in the newly established agency or department.

In addition to the above changes and various technical changes, minor amendments approved by the Subcommittee included:

Section 3.—Definitions 1 and 2 were modified to allow for demonstration projects involving solar water heating alone. This is a major form of home energy consumption, and is the most widespread application of solar energy; it is perhaps the only feasible way to currently use solar energy in certain types of buildings.

Section 5(b)(1).—The time allowed for NBS to develop performance criteria was lengthened from 80 to 120 days at the request of NBS and the suggestion of several other witnesses.

Sections 5(b)(2) and 6(b)(2).—The language setting up an architectural design competition was slightly modified in accordance with suggestions from the American Institute of Architects.

Sections 5(c)(2) and 6(d)(2).—Replaced "at least two different" by "a number of", to emphasize the desire for competition between manufacturers.

Sections 5(c)(3) and 6(d)(3).—Deleted the words "Not less than three" with respect to number of geographic regions for demonstration projects to emphasize the need for utilizing as many different geographical areas as feasible.

Section 7.—The phrase "public buildings (including schools and colleges)" was added to the list of commercial buildings in accordance with suggestions made to the Subcommittee.

Full Committee Action on H.R. 11864

Following the subcommittee actions described above, a clean bill was introduced, cosponsored by all members of the Subcommittee (including the full Committee Chairman and the Ranking Minority Member) on December 10. The clean bill, H.R. 11864, was considered by the full committee on December 14 and approved unanimously without change. On December 19, a quorum then being present, the Committee again unanimously approved the bill with no changes and recommended passage by the full House.

COMMITTEE VIEWS

Departmental Responsibilities

It is the intent of the Committee that this bill define a working arrangement between those Federal agencies best able to handle the various facets of this demonstration program, while at all times specifying a lead agency to ensure adequate management for each phase. The principal agencies are NASA and HUD, with NASA having responsibility during the first phase (development and procurement of the heating and/or cooling systems) and HUD having responsibility during the second (installation, monitoring and evaluation of the equipment and buildings).

A unique role is assigned to NBS in support of both phases. It is assigned the task of determining performance criteria, with which NASA will then work with industry in developing suitable hardware. NBS will also work with HUD in monitoring and evaluating the performance of the units.

NSF has been and will continue to be the major supporter of research in solar energy. NSF research projects have laid much of the technological foundation for this demonstration. It is expected that NSF will closely coordinate its solar program with this program, and will support activities that will further the objectives of this bill where feasible.

Organizational charts could be drawn for the two separate phases of this project. This is more properly an administrative prerogative, within the guidelines set forth in the bill.

The dissemination of information will be carried out by HUD, utilizing the existing capabilities of NASA, NSF, NBS, the Patent Office, and other organizations.

Interagency cooperation is very important in this program. Previous joint efforts have been pointed to with pride between NASA and AEC and between AEC and DOD. There is every reason to believe that the administrative approach specified in the bill will be suitable, despite obvious potential dangers in assigning specific responsibilities. The Committee believes that the agencies can avoid these dangers and successfully administer this important program.

Adequacy of Authorized Funds

During the course of the hearings on H.R. 10952, there was considerable disagreement among the witnesses concerning the adequacy of the $50 million budget. This amount was based on advice from Federal agencies and outside experts, although a more detailed cost analysis and further research data might reveal these funds to be insufficient to meet the total program as envisioned in this bill.

Although some witnesses indicated the budget was too low, others stated it was adequate. There was, however, considerable support for

increased emphasis on the commercial demonstration programs, with possible further cost increases.

The Committee feels the $50 million authorization will provide an adequate demonstration of the technical and economic feasibility of applying solar energy to heat and cool buildings. It should be emphasized that the bill does not require a specific number of residential or commercial units. It does establish 4,000 residential units as a number that will in any case meet the requirement that substantial numbers of units be produced and installed.

There may be upward or downward adjustments in the number of residential and commercial demonstration units consistent with the needs of the demonstration program and the availability of funds. Reduction in the number of residential units will not reduce costs in a linear manner, however, since a large portion of the costs will be in the R. & D. and set-up expenses.

Technological Contributions from Private Citizens

During the course of the hearings and various field visits, the Committee became aware of many demonstration projects already in existence or being built by private citizens at their own expense. A great portion of present solar heating and cooling technology has come from these sources. This bill does not directly provide funds to assist these individuals, but neither does it prohibit their participation in this demonstration. These kinds of projects may also be eligible for related research programs supported by NSF and NASA under Sections 4 and 8 of this bill, or other research activities.

Design Competitions

During the hearings on H.R. 10952 there was considerable discussion with the witnesses on the design competitions for residences compatible with solar heating and/or cooling equipment, as specified in sections 5 and 6. The language of the bill was slightly modified to reflect the Committee's wish that all potential qualified individuals be allowed to participate. Students were specifically added with the provision that they be engaged in studies at recognized schools in architecture, engineering, or related fields.

Thus the broad classification for participants includes all recognized professionals who are qualified to design houses to demonstrate solar heating and combined solar heating and cooling. This will help fulfill the dual purposes of the competition—developing a useful library of designs, and making known to the housing design market that immediate exploitation of solar energy is possible. The bill language is believed to be acceptable to the American Institute of Architects' design competition committee.

The duplication of competitions for housing designs for heating (section 5) and combined heating and cooling (section 6) is intentional. The second competition would probably be delayed to allow for the development of the more advanced combined heating and cooling equipment which could have some impact on building designs.

Solar Heating and Cooling Information Data Bank

The Solar Heating and Cooling Data Bank was added in markup and is in accordance with testimony from a number of witnesses. The

choice of HUD as the responsible agency is an obvious one, since it has close ties to the housing industry and is the Federal agency most likely to be sought out by individuals or organizations interested in solar heating or cooling. Other agencies would be utilized, and the Committee hopes that an appropriate existing information system could be utilized so that a bureaucracy need not be created.

It is not intended that this data bank carry out original research in any area, and the budget for a carefully managed data bank should not be large.

Ceilings on Loans and Unit Construction Costs

Section 10 was added in markup in response to concerns that the demonstration might be hindered by existing legislative limitations.

It is the belief of the Committee that this language removes Federal legislative or regulatory restrictions on mortgage loans or units costs to the extent of the increase due to solar heating and cooling systems.

The additional costs may include, but not be limited to, equipment, special insulation and construction materials, special construction techniques, and the auxiliary heating and/or cooling systems.

Mass Production of Units in Substantial Numbers

The Committee feels that mass production of units will help meet two goals of this demonstration act: (1) developing an industrial solar equipment capability and (2) developing a wide market for solar heating and/or cooling systems. Sufficient numbers of identical units should be produced to ensure that they not be hand-built, one-of-a-kind systems; at the same time, a large number of potential manufacturers should be involved.

It is the intent of the committee that the program test and evaluate many different concepts, without freezing designs prematurely. Appropriate changes and improvements should be possible at any time consistent with goals meeting the schedules of the demonstration program. 4,000 units is adequate to meet the requirement that "substantial numbers" of units be mass produced; this number may be reduced if lower totals can adequately meet the objectives of the demonstration program.

SECTION-BY-SECTION SUMMARY OF THE BILL

The first section contains the short title of the bill—the "Solar Heating and Cooling Demonstration Act of 1973.".

Section 2. Findings and Policy

This section sets forth the policy and purpose of the bill and the findings on which they are based.

Subsection (a) expresses the findings of the Congress—that the current fuel and energy shortage is likely to persist; that the early demonstration of the use of solar energy for heating and cooling buildings could expedite its commercial application and help relieve the demand on present fuel and energy supplies; that solar heating technology is already close to commercial application, while the commercial development of technologies for combined heating and cooling apparently presents no insoluble technical problems; and that the development and use of solar heating and cooling equipment will benefit the environment, improve our balance of trade, eliminate our dependence upon foreign energy sources, and promote the national defense.

Subsection (b) declares it to be the policy of the United States and the purpose of the bill to provide for a 3-year program to demonstrate the practical use of presently available solar heating technology, and for a 5-year program to develop and demonstrate the practical use of combined solar heating and cooling technology.

Section 3. Definitions

This section contains definitions of terms used in the bill. "Solar heating" means the use of solar energy to meet such portion of a building's total heating (or hot water) needs as may be required under performance criteria prescribed by the National Bureau of Standards. "Combined solar heating and cooling" means the use of solar energy to meet such portion of a building's total heating (or hot water) needs, and total cooling needs, as may be required under such criteria (and includes cooling by means of other methods of meeting peakload energy requirements at non-peakload times). "Residential dwellings" includes mobile homes.

Section 4. Conduct of Activities in Solar Heating and Cooling Technologies by National Aeronautics and Space Administration

This section amends section 203 of the National Aeronautics and Space Act of 1958 to direct the National Aeronautics and Space Administration to initiate, support, and carry out basic and applied re-

search, development, demonstrations, and other activities in solar heating and cooling technologies (including activities funded under sections 5, 6, and 7 of the bill).

Section 5. Development of Solar Heating Systems To Be in Residential Dwellings

This section establishes a Federal program for the early development and demonstration, by the National Aeronautics and Space Administration (NASA) and the Department of Housing and Urban Development (HUD) in cooperation with other Federal agencies, of solar heating systems to be used in residential dwellings.

Section (a) directs the Administrator of NASA, in consultation with the Secretary of HUD, to initiate and carry out the demonstration program in accordance with the succeeding provisions of the section.

Subsection (b) provides for the initial stage of the program. It directs the National Bureau of Standards (NBS), in consultation with the Administrator and the Secretary of HUD, (1) to determine, prescribe, and publish, within 120 days after enactment, performance criteria for solar heating systems to be used in residential dwellings and similar criteria (relating to suitability for solar heating) for the dwellings themselves, taking into account climatic variations, and (2) to select, as soon as possible thereafter, on the basis of design competitions open to all qualified professionals (including advanced students in architecture, engineering, and related fields), a number of designs for various types of residential dwellings which are suitable for the installation of solar heating systems meeting the applicable criteria so prescribed.

Subsection (c) provides for the actual carrying out of the program. The Administrator, in consultation with the Secretary of HUD, would first enter into contracts for the development (for commercial production and residential use) of solar heating systems meeting the applicable performance criteria prescribed under subsection (b) (and for the manufacture, production, and installation of prototype solar heating systems in dwellings meeting the applicable criteria if he determines that it would expedite the program).

The Administrator would then enter into contracts with various persons and firms for the actual manufacture on a mass production basis of the solar heating systems so developed (including spare and replacement parts).

Finally the solar heating systems so manufactured, in sufficient numbers to assure a realistic and effective demonstration (approximately 1,000 such systems), would be installed in residential dwellings located on Federal or federally-administered property (for observation and monitoring by Federal personnel) in conjunction with and under arrangements to be made by the Secretary of Defense; and an equal number of such systems would be installed in privately-owned and occupied residential dwellings in conjunction with and under arrangements to be made by the Secretary of HUD. Title to and ownership of any solar heating system installed in a private dwelling would remain in the United States after the installation unless and until the owner-occupant of the dwelling involved (pursuant to an agreement

made at the time of the installation), including any subsequent owner-occupant who makes such an agreement, has observed and monitored (or permitted the Secretary's agents to observe and monitor) the performance and operation of the system for 5 years and has regularly furnished the Secretary with such reports thereon as the Secretary may require. The dwellings used in the program are to be located in different geographical areas to assure a realistic and effective demonstration of both the systems and the dwellings involved under varying climatic conditions.

Subsection (d) vests in the Secretary of HUD (utilizing NBS and in consultation with the Administrator and the Secretary of Defense) the general function of monitoring the performance and operation of all solar heating systems installed under the program, collecting and evaluating information thereon, taking such actions as are necessary to assure that the program effectively carries out the objectives of the bill, and maintaining continuing liaison with the building industry and related industries and interests to assure that the projected benefits of the program are and will continue to be effectively realized.

Section 6. Development of Combined Solar Heating and Cooling Systems To Be Used in Residential Dwellings

This section establishes a Federal program for the development and demonstration of combined solar heating and cooling systems to be used in residential dwellings which includes the same steps (the initial stage involving the determination of performance criteria by NBS and the selection of approved dwelling designs, the actual carrying out of the program by the Administrator of NASA through contracts for the development and manufacture of approved solar heating and cooling systems and the installation of such systems in at least 2,000 approved dwellings, and the monitoring of such systems by the Secretary of HUD) as the program established by section 5 for the development and demonstration of solar heating systems alone, and which is otherwise the same as that program in all procedural respects with a single exception:

Reflecting the fact that the technologies for combined solar heating and cooling are not as close to the point of commercial application as the technologies for solar heating alone, the program under this section of the bill includes as an additional step (immediately following the initial stage of the program and before the stage of contracting for development and manufacture) a period of research, development, testing, and demonstration design to provide the additional technological resources necessary for the development and commercial application of combined solar heating and cooling systems under the program as contemplated by the bill.

Section 7. Development of Solar Heating and Cooling Systems for Commercial Buildings

This section directs the Administrator of NASA and the Secretary of HUD, in consultation with NBS and the General Services Administration (and concurrently with the demonstration programs involving residential dwellings under sections 5 and 6 of the bill), to carry out appropriate projects and activities for the early development and

demonstration of combined solar heating and cooling for use in apartment buildings, office buildings, factories, agricultural structures, public buildings, schools, and other commercial and industrial buildings. These projects and activities would take into account the special needs of and individual differences in such buildings based on size, function, and other relevant factors.

Section 8. Funding of Solar Energy Research by National Science Foundation

Subsection (a) of this section amends section 3 of the National Science Foundation Act of 1950 to direct the National Science Foundation (NSF) to initiate and support basic and applied research relating to solar energy development.

Subsection (b) emphasizes that NSF's research activities under the amendment made by subsection (a) are to be in support of the objectives of the bill and of the new solar heating and cooling technologies demonstrated by NASA under sections 4, 5, 6, and 7. The Director of NSF would be authorized to fund these activities and to utilize for this purpose any funds appropriated or transferred to him.

Section 9. Dissemination of Information and Other Actions To Promote Practical Use of Solar Heating and Cooling Technologies

Subsection (a) of this section directs the Secretary of HUD, in coordination with the Administrator of NASA, NBS, NSF, the Patent Office, and other Federal agencies, to assure that full information with respect to the demonstration programs and other activities under the bill is made available to public authorities, the building industry and related segments of the economy, and the public at large, with the objective of promoting and facilitating the early and widespread practical use of solar energy for heating and cooling buildings.

Subsection (b) further directs the Secretary of HUD to study and investigate existing building codes, zoning ordinances, and related laws and practices to determine their effect upon the practical use of solar energy for heating and cooling buildings and the extent to which they should be changed to permit or facilitate such use.

Subsection (c) directs the Secretary of HUD (utilizing the capabilities of NASA, NBS, and NSF and the existing data base of scientific and technical information in Federal agencies) to establish and operate a Solar Heating and Cooling Information Data Bank to collect, review, process, and disseminate solar heating and cooling information and data, including relevant types of technical information and information on the physical and chemical properties of solar heating and cooling materials, climatic conditions, and the engineering performance of solar heating and cooling devices. Retrieval and dissemination of this information would be provided for Federal, State, and local government organizations active in the energy field (and their contractors), to colleges and universities in related research and consulting activities, and to the private sector upon request in appropriate cases.

Subsection (d) directs each Federal officer and agency engaged in activities under the bill to include a full description of such activities current and projected (with related recommendations) in his or its annual report to the President and the Congress. In addition, the Secretary of HUD is directed to submit annually a special report summarizing all of the current and projected activities of the various Federal officers and agencies having functions under the bill in order to provide a comprehensive overall view of the various programs under the bill.

Section 10. Dollar Limitations on Federally-Assisted or Federally-Constructed Housing

This section is designed to expedite the demonstration programs under the bill, and assure that assistance under the various Federal housing laws will be available for dwellings equipped with solar heating or solar heating and cooling systems under those programs, by providing in effect that the additional cost of such systems is to be disregarded in the application of those laws.

Subsection (a) provides that in determining the maximum dollar amount of any federally-insured mortgage loan or the maximum cost of any federally-constructed housing, where the law providing for the loan or construction specifies such maximum amount or cost and the structure involved is furnished with solar heating or solar heating and cooling equipment under the bill, the maximum amount or cost so specified will be deemed to be increased by the difference between the price or cost of the structure including such equipment and the price or cost of the structure with such equipment replaced by conventional heating or heating and cooling equipment. In the case of a mortgage loan, this difference would also be taken into account for purposes of applying any statutory maximum loan-to-value or -cost ratio (and, where downpayment rates vary for successive increments of value or cost, would be subject to the lowest such rate).

Subsection (b) defines the terms "mortgage loan" and "federally-assisted mortgage loan" for purposes of subsection (a). The latter term is defined as broadly as possible, so as to include any mortgage loan made by a lender who is subject to Federal regulation or whose deposits or accounts are federally insured, any loan which is made, insured, guaranteed, supplemented, or otherwise assisted in any way by a Federal agency or under a Federal program, any loan which is eligible for purchase by FNMA, GNMA, or FHLMC, and certain other loans made by lenders subject to the Consumer Credit Protection Act of 1968.

Subsection (c) defines the term "federally-constructed housing" to include any residential or multifamily housing which is constructed by a Federal agency and is designed for one or more particular types or classes of persons under a Federal program (including Defense Department housing for servicemen and their families), and any housing which is constructed by a State or local agency with Federal assistance for one or more particular types or classes of persons under a State or local program.

Section 11. Encouragement and Protection of Small Business

This section directs all Federal officers and agencies performing functions under the bill to assure that small business concerns are given a realistic and adequate opportunity to participate in the new solar heating and solar heating and cooling demonstration programs.

Section 12. Regulations

This section directs the Administrator of NASA, in consultation with NBS, NSF, the Secretary of HUD, the Administrator of GSA, the Secretary of Defense, and other appropriate Federal officers and agencies, to prescribe the regulations necessary to carry out the programs under the bill promptly and efficiently. Each such officer or agency, in consultation with the Administrator, could prescribe any additional regulations necessary for the performance of his or its particular functions under the bill.

Section 13. Transfer of Functions

This section, recognizing the possibility that a new Energy Research and Development Administration or similar Federal agency will be created with overall jurisdiction over the energy research and development functions of the United States and the desirability of assuring that such functions do not remain fragmented after the creation of that agency, provides for the transfer to such new agency under OMB regulations, within 60 days after its creation (or after the enactment of the bill if later), of all of the functions vested by the bill in NASA and NSF along with related records, documents, personnel, obligations, and other items.

Section 14. Authorization of Appropriations

This section authorizes the appropriation of $50,000,000 to the Administrator of NASA to enable him, over a 5-fiscal-year period, to carry out his functions under the bill and to reimburse NBS, NSF, the Secretary of HUD, the Secretary of Defense, and GSA for expenses incurred by them in carrying out their functions under the bill.

COST AND BUDGET DATA

Discussion with qualified experts before, during, and after the extensive hearings on H.R. 10952 verified $50 million as a reasonable sum for this demonstration program. This includes agency staff, prototype development, and equipment purchase costs for both the residential and commercial portions of the demonstration program.

No five year budget estimates have been received from Federal agencies. In accordance with the requirements of sec. 252(b) of the Legislative Reorganization Act of 1970, the Committee estimates the costs of the program provided for in the bill are:

	Millions
Fiscal year 1975	$4.5
Fiscal year 1976	8.0
Fiscal year 1977	11.5
Fiscal year 1978	12.5
Fiscal year 1979	13.5

COMMITTEE RECOMMENDATIONS

A quorum being present, the Committee, by voice vote, unanimously approved the bill.

DEPARTMENT RECOMMENDATIONS

Formal written reports requested from the National Aeronautics and Space Administration, the Departments of Commerce, Defense, and Housing and Urban Development, General Accounting Office, the National Science Foundation and the General Services Administration have not been received. However, testimony from all of these organizations except the General Accounting Office was received and is part of the Hearing Record.

CHANGES IN EXISTING LAW MADE BY THE BILL, AS REPORTED

In compliance with clause 3 of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

SECTION 203 OF THE NATIONAL AERONAUTICS AND SPACE ACT OF 1958

FUNCTIONS OF THE ADMINISTRATION

SEC. 203. (a) The Administration, in order to carry out the purpose of this Act, shall—

(1) plan, direct, and conduct aeronautical and space activities;

(2) arrange for participation by the scientific community in planning scientific measurements and observations to be made through use of aeronautical and space vehicles, and conduct or arrange for the conduct of such measurements and observations; and

(3) provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.

(b) The Administration shall initiate, support, and carry out basic and applied research, development, demonstrations, and other related activities in solar heating and cooling technologies, including (to the extent that funds are appropriated therefor) activities as provided for in sections 5, 6, and 7 of the Solar Heating and Cooling Demonstration Act of 1973.

[(b)] *(c)* In the performance of its functions the Administration is authorized—

(1) to make, promulgate, issue, rescind, and amend rules and regulations governing the manner of its operations and the exercise of the powers vested in it by law;

(2) to appoint and fix the compensation of such officers and employees as may be necessary to carry out such functions. Such officers and employees shall be appointed in accordance with the civil-service laws and their compensation fixed in accordance with the Classification Act of 1949, except that (A) to the extent the Administrator deems such action necessary to the discharge of his responsibilities, he may appoint not more than four hundred and twenty-five of the scientific, engineering, and administrative personnel of the Administration without regard to such laws, and

may fix the compensation of such personnel not in excess of the highest rate of grade 18 of the General Schedule of the Classification Act of 1949, as amended, and (B) to the extent the Administrator deems such action necessary to recruit specially qualified scientific and engineering talent, he may establish the entrance grade for scientific and engineering personnel without previous service in the Federal Government at a level up to two grades higher than the grade provided for such personnel under the General Schedule established by the Classification Act of 1949, and fix their compensation accordingly;

(3) to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain laboratories, research and testing sites and facilities, aeronautical and space vehicles, quarters and related accommodations for employees and dependents of employees of the Administration, and such other real and personal property (including patents), or any interest therein, as the Administration deems necessary within and outside the continental United States; to acquire by lease or otherwise, through the Administrator of General Services, buildings or parts of buildings in the District of Columbia for the use of the Administration for a period not to exceed ten years without regard to the Act of March 3, 1877 (40 U.S.C. 34); to lease to others such real and personal property; to sell and otherwise dispose of real and personal property (including patents and rights thereunder) in accordance with the provisions of the Federal Property and Administrative Services Act of 1949, as amended (40 U.S.C. 471 et seq.); and to provide by contract or otherwise for cafeterias and other necessary facilities for the welfare of employees of the Administration at its installations and purchase and maintain equipment therefor;

(4) to accept unconditional gifts or donations of services, money, or property, real, personal, or mixed, tangible or intangible;

(5) without regard to section 3648 of the Revised Statutes, as amended (31 U.S.C. 529), to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate, with any agency or instrumentality of the United States, or with any State, Territory, or possession, or with any political subdivision thereof, or with any person, firm, association, corporation, or educational institution. To the maximum extent practicable and consistent with the accomplishment of the purpose of this Act, such contracts, leases, agreements, and other transactions shall be allocated by the Administrator in a manner which will enable small-business concerns to participate equitably and proportionately in the conduct of the work of the Administration;

(6) To use, with their consent, the services, equipment, personnel, and facilities of Federal and other agencies with or without reimbursement, and on a similar basis to cooperate with other public and private agencies and instrumentalities in the use of services, equipment, and facilities. Each department and agency of the

Federal Government shall cooperate fully with the Administration in making its services, equipment, personnel, and facilities available to the Administration, and any such department or agency is authorized, notwithstanding any other provision of law, to transfer to or to receive from the Administration without reimbursement, aeronautical and space vehicles, and supplies and equipment other than administrative supplies or equipment;

(7) to appoint such advisory committees as may be appropriate for purposes of consultation and advice to the Administration in the performance of its functions;

(8) to establish within the Administration such offices and procedures as may be appropriate to provide for the greatest possible coordination of its activities under this Act with related scientific and other activities being carried on by other public and private agencies and organizations;

(9) to obtain services as authorized by section 15 of the Act of August 2, 1946 (5 U.S.C. 55a), at rates not to exceed $100 per diem for individuals;

(10) when determined by the Administrator to be necessary, and subject to such security investigations as he may determine to be appropriate, to employ aliens without regard to statutory provisions prohibiting payment of compensation to aliens;

(11) to provide by concession, without regard to section 321 of the Act of June 30, 1932 (47 Stat. 412; 40 U.S.C. 303b), on such terms as the Administrator may deem to be appropriate and to be necessary to protect the concessioner against loss of his investment in property (but not anticipated profits) resulting from the Administration's discretionary acts and decisions, for the construction, maintenance, and operation of all manner of facilities and equipment for visitors to the several installations of the Administration and, in connection therewith, to provide services incident to the dissemination of information concerning its activities to such visitors, without charge or with a reasonable charge therefor (with this authority being in addition to any other authority which the Administration may have to provide facilities, equipment, and services for visitors to its installations). A concession agreement under this paragraph may be negotiated with any qualified proposer following due consideration of all proposals received after reasonable public notice of the intention to contract. The concessioner shall be afforded a reasonable opportunity to make a profit commensurate with the capital invested and the obligations assumed, and the consideration paid by him for the concession shall be based on the probable value of such opportunity and not on maximizing revenue to the United States. Each concession agreement shall specify the manner in which the concessioner's records are to be maintained, and shall provide for access to any such records by the Administration and the Comptroller General of the United States for a period of five years after the close of the business year to which such records relate. A concessioner may be accorded a possessory interest, consisting of all incidents of ownership except legal title (which shall vest in the

United States), in any structure, fixture, or improvement he constructs or locates upon land owned by the United States; and, with the approval of the Administration, such possessory interest may be assigned, transferred, encumbered, or relinquished by him, and, unless otherwise provided by contract, shall not be extinguished by the expiration or other termination of the concession and may not be taken for public use without just compensation;

(12) with the approval of the President, to enter into cooperative agreements under which members of the Army, Navy, Air Force, and Marine Corps may be detailed by the appropriate Secretary for services in the performance of functions under this Act to the same extent as that to which they might be lawfully assigned in the Department of Defense;

(13) (A) to consider, ascertain, adjust, determine, settle, and pay, on behalf of the United States, in full satisfaction thereof, any claim for $5,000 or less against the United States for bodily injury, death, or damage to or loss of real or personal property resulting from the conduct of the Administration's functions as specified in subsection (a) of this section, where such claim is presented to the Administration in writing within two years after the accident or incident out of which the claim arises; and

(B) if the Administration considers that a claim in excess of $5,000 is meritorious and would otherwise be covered by this paragraph, to report the facts and circumstances thereof to the Congress for its consideration; and

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SECTION 3 OF THE NATIONAL SCIENCE FOUNDATION ACT OF 1950

FUNCTIONS OF THE FOUNDATION

SEC. 3. (a) The Foundation is authorized and directed—

(1) to initiate and support basic scientific research and programs to strengthen scientific research potential and science education programs at all levels in the mathematical, physical, medical, biological, engineering, social, and other sciences, by making contracts or other arrangements (including grants, loans, and other forms of assistance) to support such scientific and educational activities and to appraise the impact of research upon industrial development and upon the general welfare;

(2) to award, as provided in section 10, scholarships and graduate fellowships in the mathematical, physical, medical, biological, engineering, social, and other sciences;

(3) to foster the interchange of scientific information among scientists in the United States and foreign countries;

(4) to foster and support the development and use of computer and other scientific methods and technologies, primarily for research and education in the sciences;

(5) to evaluate the status and needs of the various sciences as evidenced by programs, projects, and studies undertaken by agencies of the Federal Government, by individuals, and by public and private research groups, employing by grant or contract such

consulting services as it may deem necessary for the purpose of such evaluations; and to take into consideration the results of such evaluations in correlating the research and educational programs undertaken or supported by the Foundation with programs, projects, and studies undertaken by agencies of the Federal Government, by individuals, and by public and private research groups;

(6) to maintain a current register of scientific and technical personnel, and in other ways to provide a central clearinghouse for the collection, interpretation, and analysis of data on the availability of, and the current and projected need for, scientific and technical resources in the United States, and to provide a source of information for policy formulation by other agencies of the Federal Government; and

(7) to initiate and maintain a program for the determination of the total amount of money for scientific research, including money allocated for the construction of the facilities wherein such research is conducted, received by each educational institution and appropriate nonprofit organization in the United States, by grant, contract, or other arrangement from agencies of the Federal Government, and to report annually thereon to the President and the Congress.

(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the Office of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official.

(c) In addition to the authority contained in subsections (a) and (b), the Foundation is authorized to initiate and support scientific research, including applied research, at academic and other nonprofit institutions. When so directed by the President, the Foundation is further authorized to support, through other appropriate organizations, applied scientific research relevant to national problems involving the public interest. In exercising the authority contained in this subsection, the Foundation may employ by grant or contract such consulting services as it deems necessary, and shall coordinate and correlate its activities with respect to any such problem with other agencies of the Federal Government undertaking similar programs in that field.

(d) The Board and the Director shall recommend and encourage the pursuit of national policies for the promotion of basic research and education in the sciences.

(e) The Director shall initiate and support basic and applied research relating to solar energy development, as provided in section 8 (b) of the Solar Heating and Cooling Demonstration Act of 1974.

[(e)] (*f*) In exercising the authority and discharging the functions referred to in the foregoing subsections, it shall be one of the objectives of the Foundation to strengthen research and education in the sciences, including independent research by individuals, throughout the United States, and to avoid undue concentration of such research and education.

[(f)] (*g*) The Foundation shall render an annual report to the President for submission on or before the 15th day of January of each year to the Congress, summarizing the activities of the Foundation and making such recommendations as it may deem appropriate. Such report shall include information as to the acquisition and disposition by the Foundation of any patents and patent rights.

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